Jordan University
Faculty Of Medicine

Nervous System Part 1

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The nervous system

It is divided into 2 major divisions:

1) **Central Nervous System (CNS):** found within the bones & consists of:
   * The Brain: within the skull
   * The spinal cord: within the vertebral canal.

2) **Peripheral Nervous System (PNS):** Consists of:

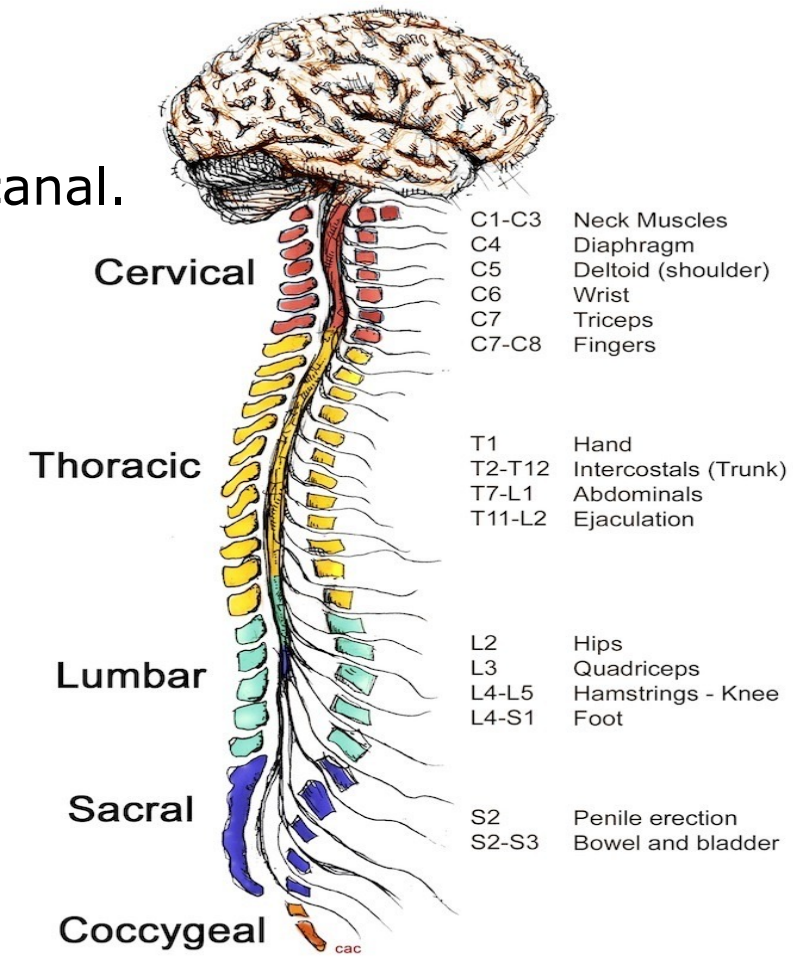
A) Autonomic nervous system (ANS) : supplies involuntary structures, e.g. Cardiac muscle and Smooth muscles which is divided into:
   * Sympathetic nervous system.
   * Parasympathetic nervous system.

B) Somatic nerves (SNS): supplies Voluntary structures body wall and limbs.
   * Cranial nerves (12 pairs): Connected to the brain.
   * Spinal nerves (31 pairs): Connected to the spinal cord.

The central nervous system

It consists of:

1) The brain: Within the skull.
2) The spinal cord: Within the vertebral canal.



THE BRAIN

It consists of:

1) Cerebrum:

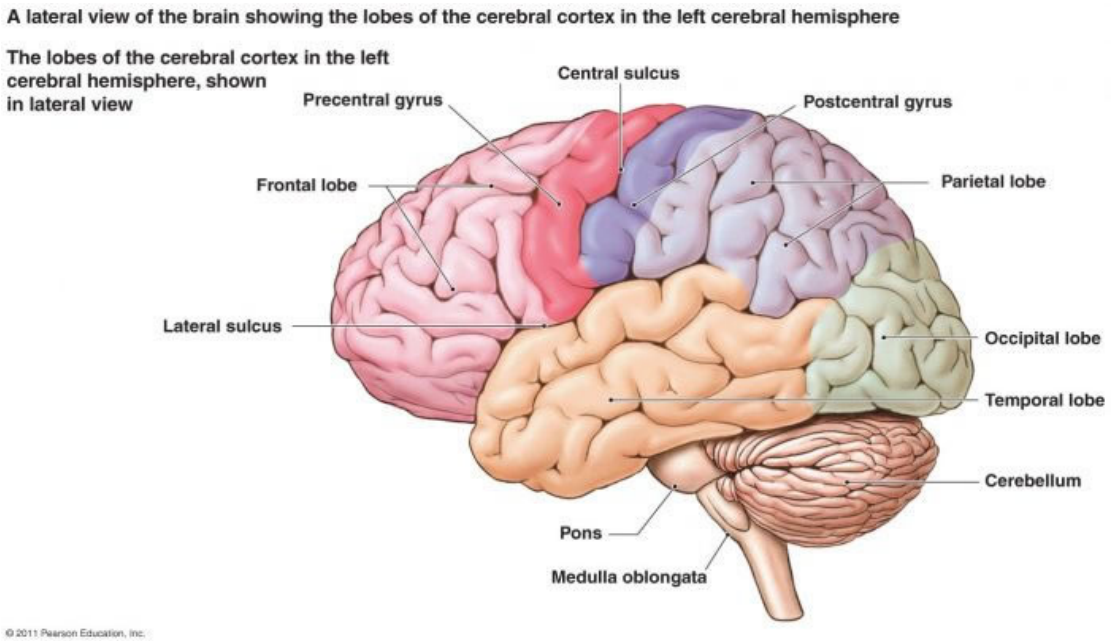
- 2 Cerebral hemispheres separated from each other by median fissure

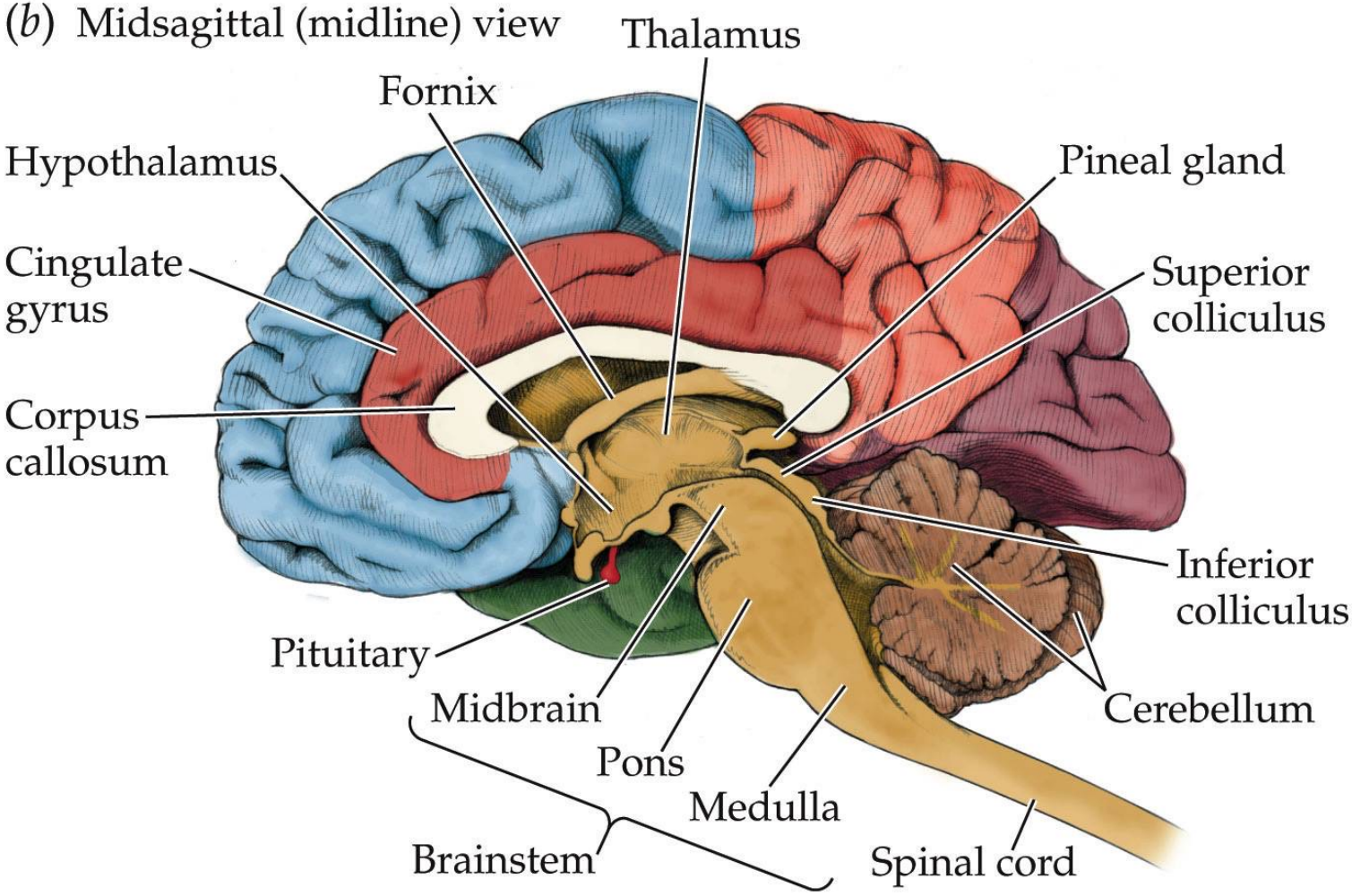
- Diencephalon

2) **Brain Stem:**

- Midbrain
- Pons
- Medulla

3**) Cerebellum:**





***Biological Psychology 6e*, Figure 2.12 (Part 2)**

REED ONLY

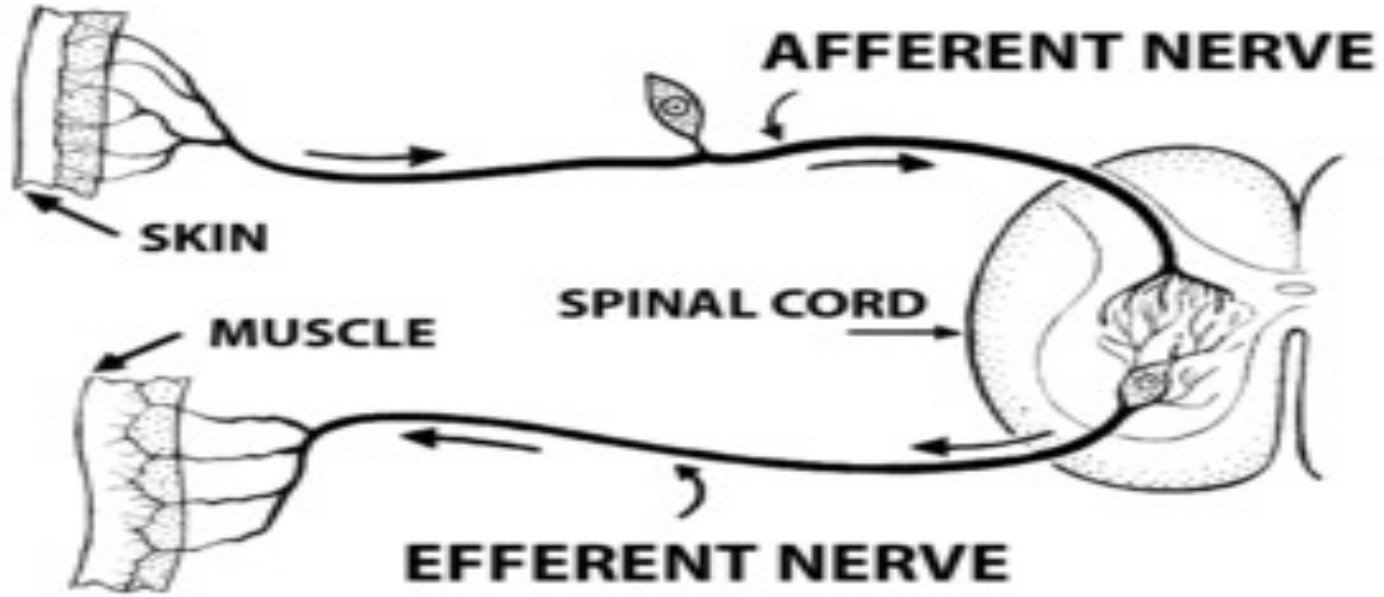
Diencephalon

1. Epithalamus
2. Thalamus
3. Subthalamus
4. Metathalamus
5. HypoThalamus

Functional Classification of Neurons:

1) Afferent (sensory) neurons: convey information from tissues and organs into the central nervous system (CNS).

2) Efferent (motor)neurons: transmit signals from the CNS to the effector organs (muscles & glands).



Cranial Nerves

Watch this video

https://youtu.be/sAFaTaavmO8?feature=shared

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Key Facts of cranial nerves

- Like spinal nerves, **cranial nerves** are bundles of sensory or motor fibers that innervate muscles or glands; carry impulses from sensory receptors.
- There are **twelve** pairs of cranial nerves, which are numbered I to XII (1 :12)
- They are called **cranial nerves** because they emerge from brain and passes through foramina or fissures in the skull.

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Types of cranial nerve fibers

Basis of classification (Three letter system)

First letter

G : General : types of fibers found both in spinal nerves and cranial nerves.

S : Special : types of fibers only found in cranial nerve.

Second letter

S : Somatic : types of fibers innervating structures derived from somites.

V : Visceral : types of fibers innervating gut, structures derived from or associated with gut and branchial arches; also vascular system, smooth muscle, internal organs and glands.

Third letter

A : Afferent : sensory fibers.

E : Efferent : motor fibers to skeletal and smooth muscle; also secretomotor fibers to glands.

Afferent nerves ARRIVE at the brain.

Efferent nerves EXIT from the brain

Cranial Nerve Fibers

Afferent (Sensory)

Somatic

General (GSA)

cutaneous sensation (pain, temperature , ect.)

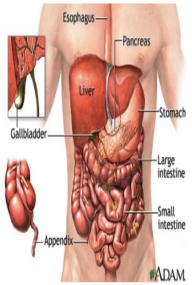
Special (SSA)

vision, hearing, equilibrium

Visceral

General (GVA)

visceral information such as distention of organs and Viscera



Special (SVA)

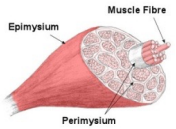
Smell Taste

Efferent (Motor)

Somatic

General (GSE)

Motor To Skeletal Muscles

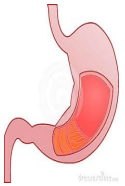


Special (SSE)

Visceral

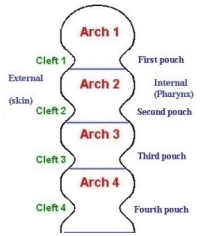
General (GVE)

Autonomic Fibers, To smooth muscles, cardiac muscle, and glands



Special (SVE)

To Skeletal muscles derived from brachial arches



12 Cranial Nerves:

Out **O**f **O**ur **T**roubled **T**imes
Arose **F**ear, **V**ery **G**reat
Violence **A**nd **H**atred

1. **O**lfactory
2. **O**ptic
3. **O**culomoter
4. **T**rochlear
5. **T**rigeminal
6. **Abducens**
7. **F**acial
8. **V**estibulocochlear (**A**uditory)
9. **G**lossopharyngeal
10. **V**agus
11. **A**ccessory
12. **H**ypoglossal

MOTOR vs. SENSORY

Motor or Sensory? or Both?

Some Say Money Matters, But My Brother Says Big Brains Matter More

I – Sensory

II – Sensory

III – Motor

IV – Motor

V – Both

VI – Motor

VII – Both

VIII – Sensory

IX – Both

X – Both

XI – Motor

XII – Motor

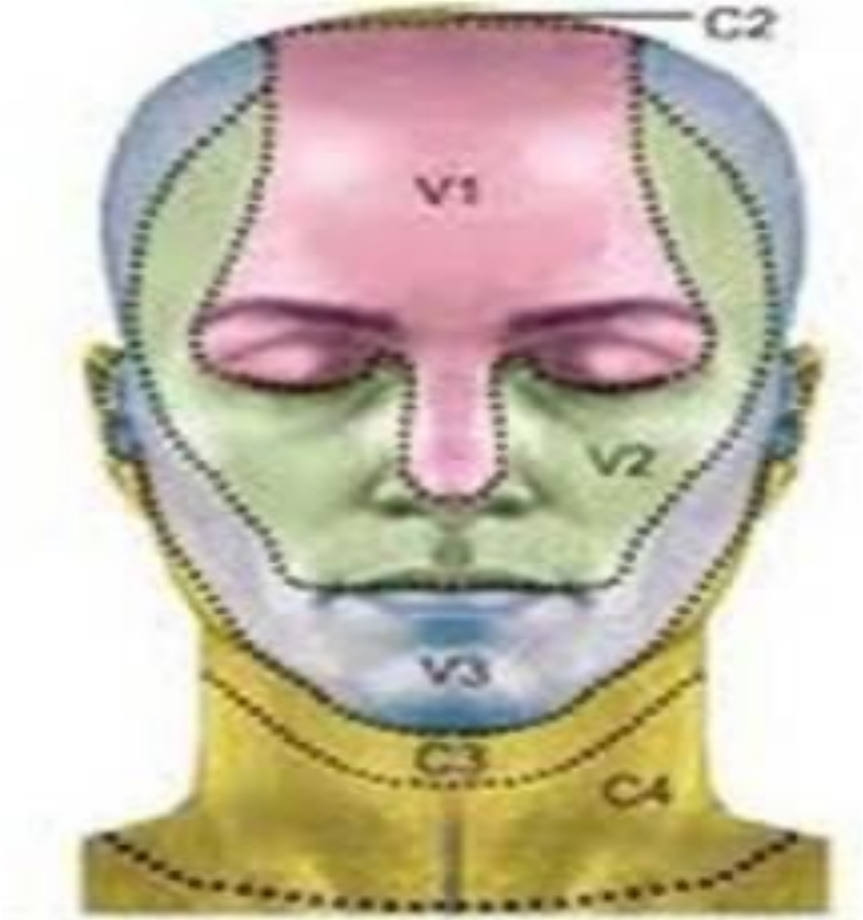
N	Name	Main Function	Effect of lesion
1	**O**lfactory	Smell	**LESIONS ARE REED ONLY**
2	**O**ptic	Vision	
3	**O**culomoter	Movement of the eye	Squint
4	**T**rochlear	Movement of the eye	**Squint**
5	**T**rigeminal Divided into V1:Opthalamic V2:Maxillary V3:Mandibular	Sensory to face Motor to muscles of mastication	
6	**A**bducens	Movement of the eye	Squint
7	**F**acial	Motor to muscle of the face **Lacrimation**	

N	Name	Main Function	Effect of lesion
8	**V**estibulocochlear (Auditory)	Hearing and sensation of position and movement of head.	**LESIONS ARE REED ONLY**
9	**G**lossopharyngeal	Sensory to tonsil, palate, Pharynx Taste sensation of post.1/3 of tongue	Deviation the uvula to normal side
10	**V**agus	Sensory ,motor to larynx Visceral sensation to heart ,lungs, stomach ,small intestine ,large intestine till right 2/3 of transverse colon	
11	**A**ccessory	Motor to sternomastoid and trapezius	
12	**H**ypoglossal	Motor to muscles of tongue	Deviation of the tongue to the paralyzed side ***The Tongue tell the truth***

Sensory :

Trigeminal Divided into

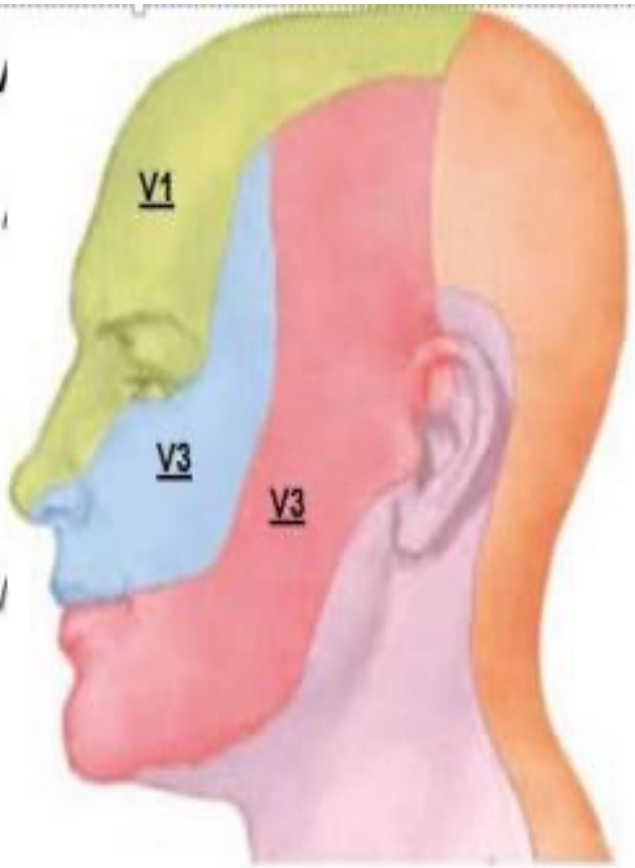
V1:Opthalamic V2:Maxillary V3:Mandibular



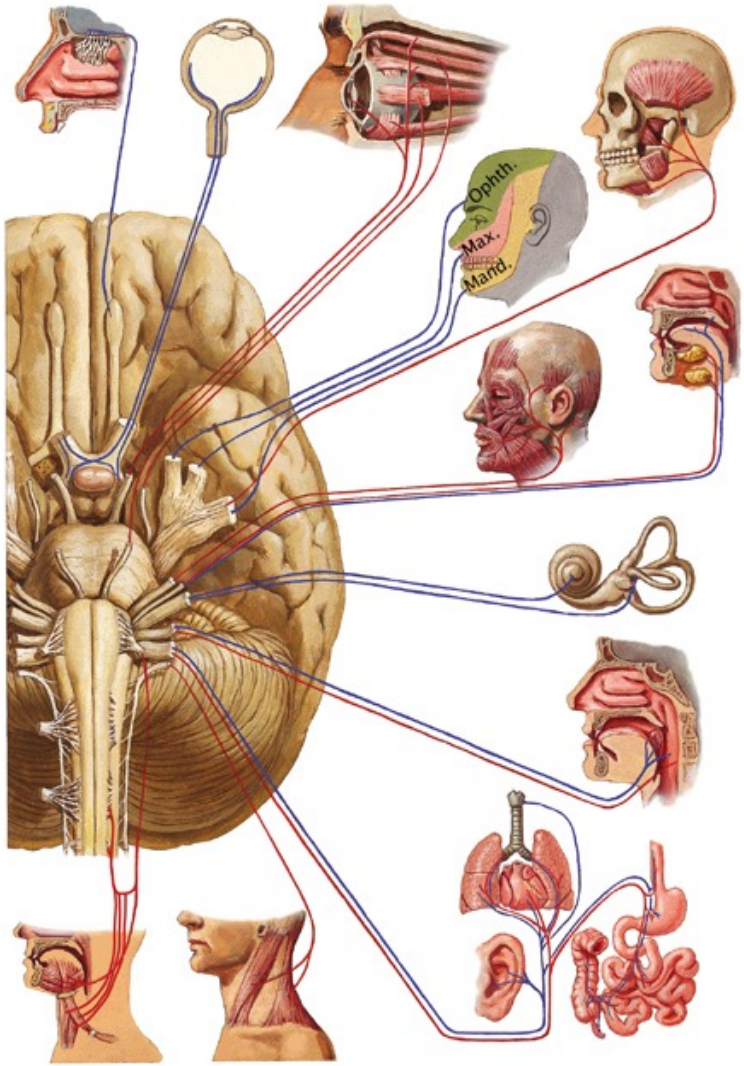
Trigeminal Nerve /CN V

Branches:

1. Ophthalmic Division / Nerve (V1)
2. Maxillary Division / Nerve(V2)
2. Mandibular Division / Nerve(V3)



N	Name	Attachment to the brain
1	**O**lfactory	**Cerebrum**
2	**O**ptic	
3	**O**culomoter	Midbrain
4	**T**rochlear	
5	**T**rigeminal	**Pons**
6	**A**bducent	
7	**F**acial	
8	**V**estibulocochlear	
9	**G**lossopharyngeal	Medulla
10	**V**agus	
11	**A**ccessory	
12	**H**ypoglossal	



Origin of Cranial nerves

Cerebrum

- I Olfactory
- II Optic

Midbrain

- III Oculomotor
- IV Trochlear

Pons

- V Trigeminal
- VI Abducens
- VII Facial

Medulla

- VIII Vestibulocochlear
- IX Glossopharyngeal
- X Vagus
- XII Hypoglossal

Thank you!

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Nervous System Part 2

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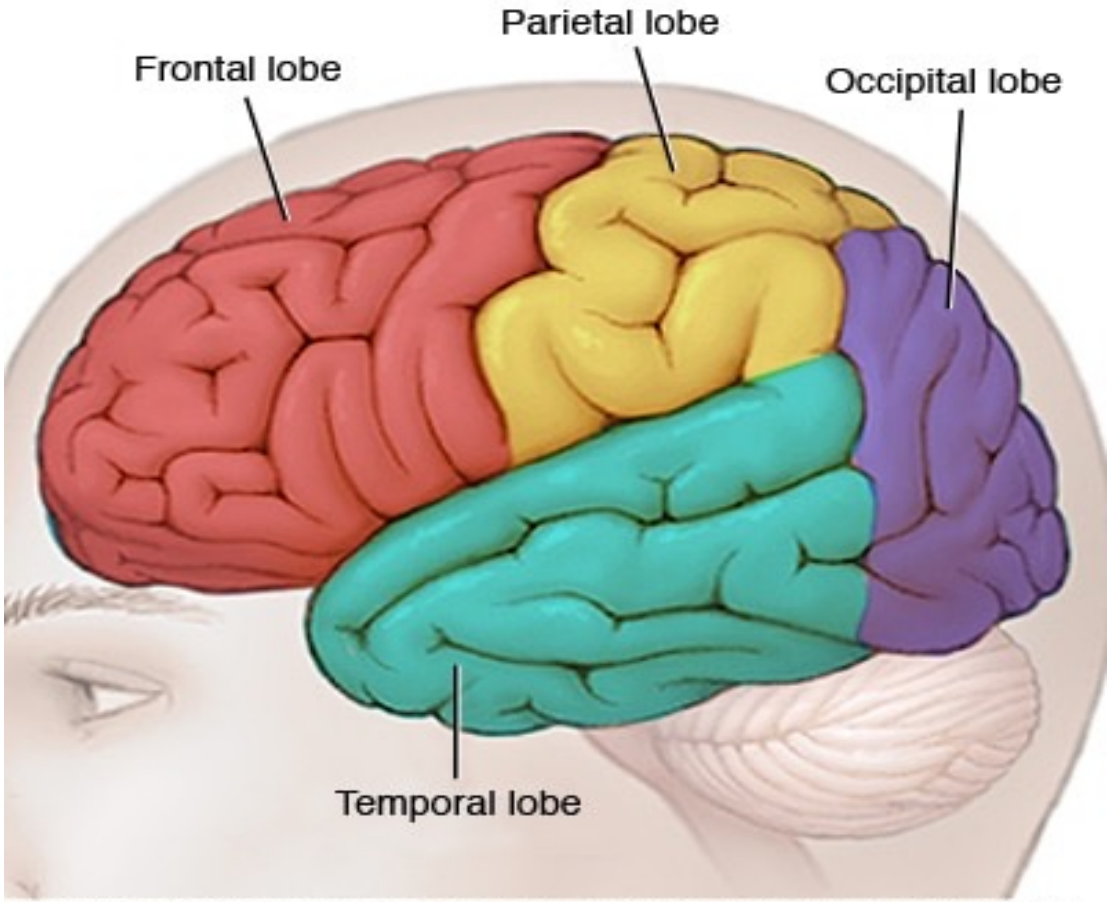
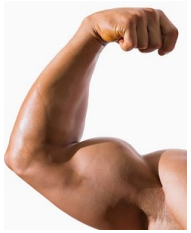
THE CEREBRAL HEMISPHERES

- The cerebral hemisphere is divided into 4 lobes by
- The central sulcus.
- Lateral fissure.
- Each hemisphere is divided into 4 lobes:
- - Frontal lobe.
- - Parietal lobe.
- - Temporal lobe.
- - Occipital lobe.



The main functional areas of the different lobes of the brain



The Frontal lobe:

- Contains **motor area** which controls muscles of the opposite half of the body.

The parietal lobe:

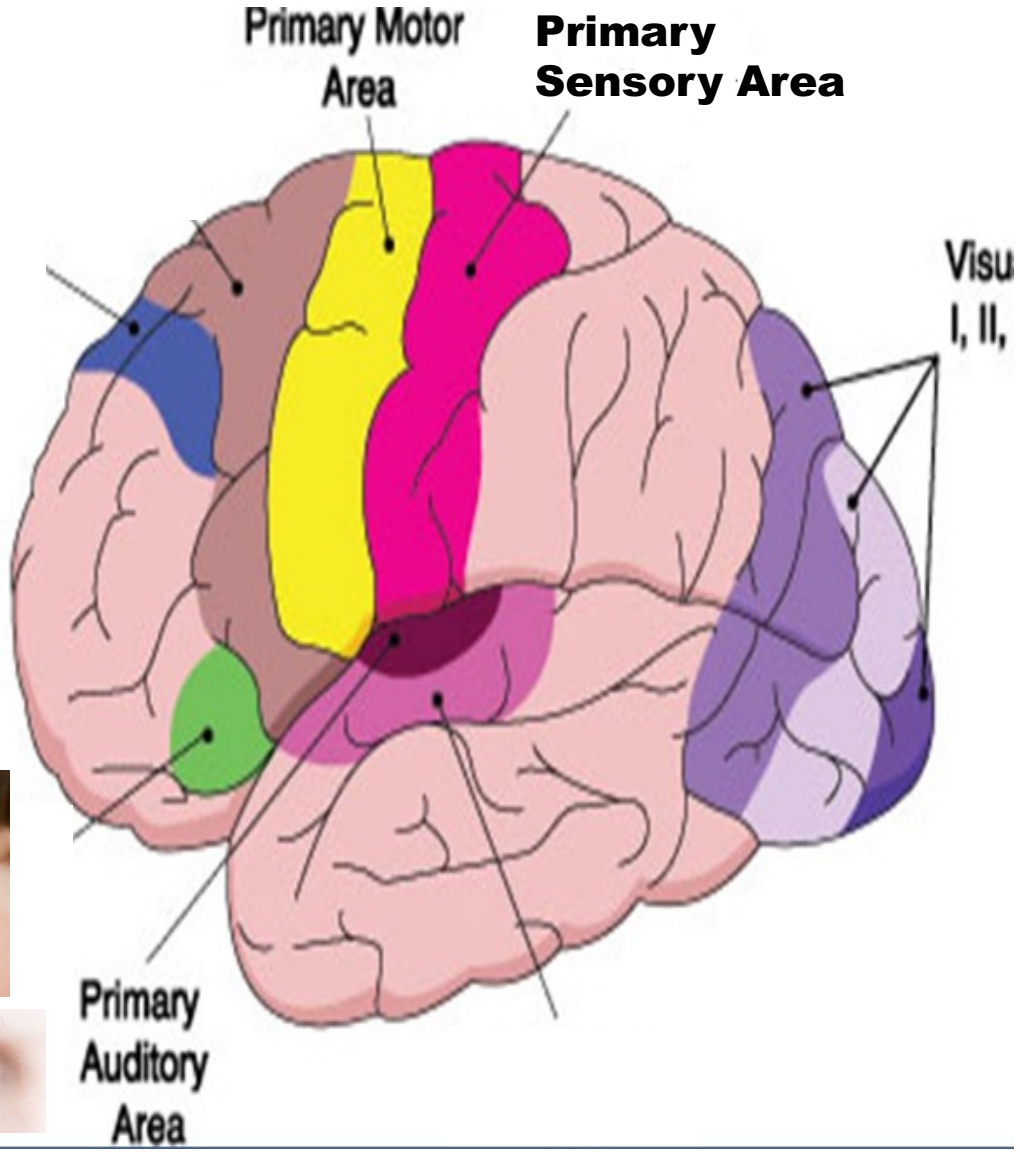
- Contains the **sensory area** for the opposite half of the body.

The temporal lobe:

Contains **hearing center**

The occipital lobe:

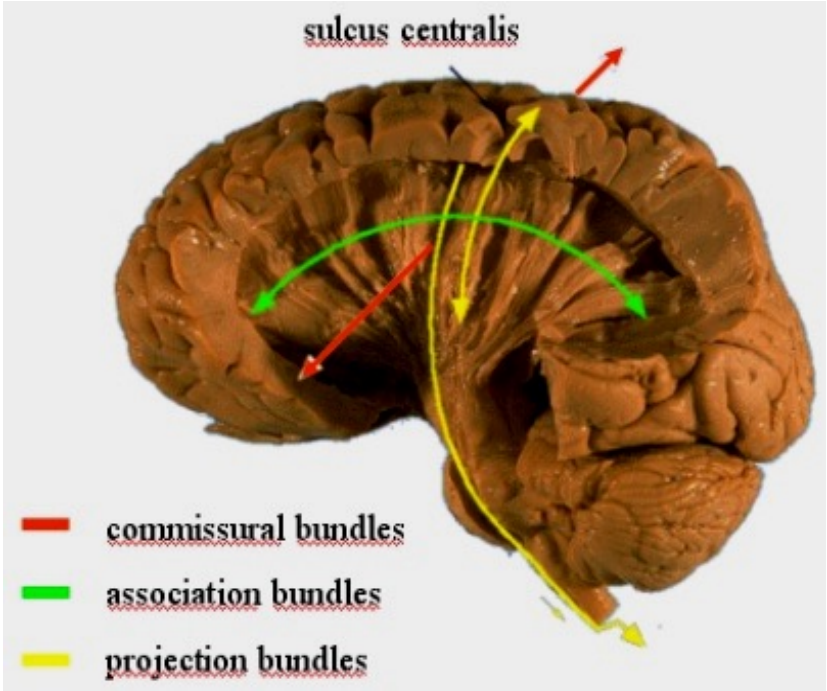
Contains center for **vision**

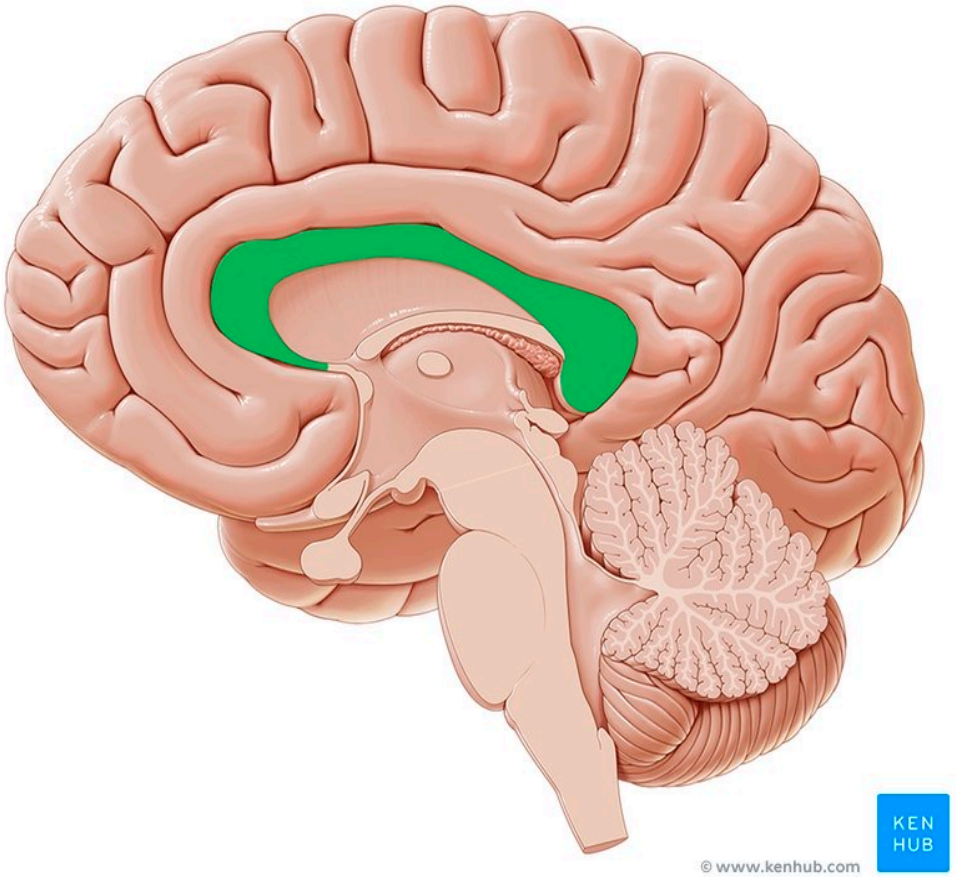


The white matter of the brain

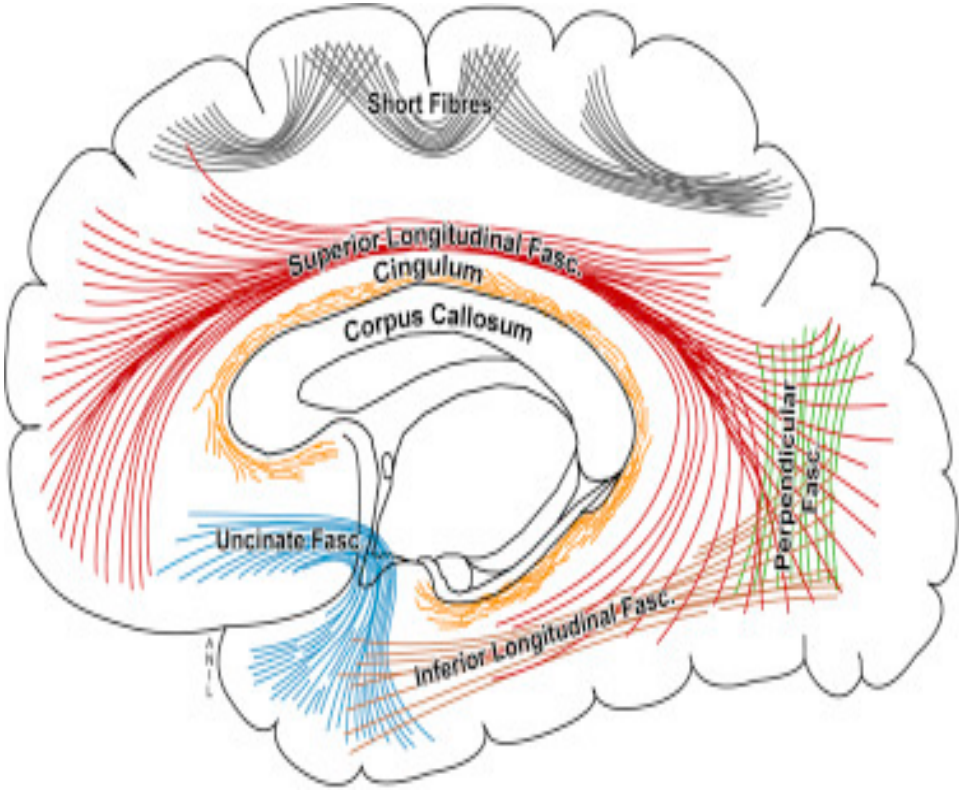
The white matter of the brain consist of:

1) **Association fibers:** Connect different areas in the same hemisphere.
2) **Commissural fibers:** Connect similar areas in the 2 hemispheres as corpus callosum
3) **Projection fibers: Fibers** from & to the cerebral cortex as internal capsule



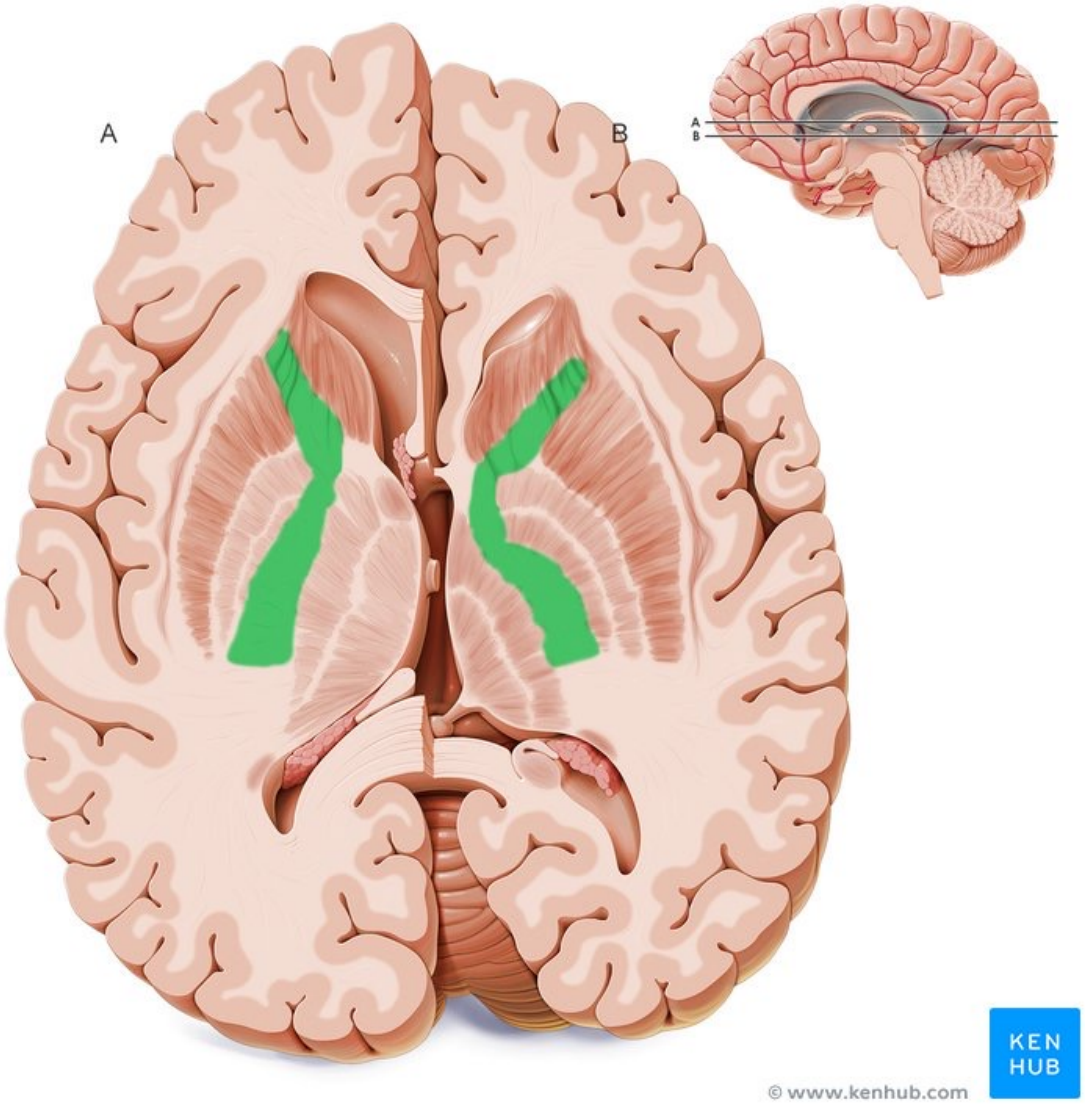


Corpus callosum



Association fibers

Internal capsule

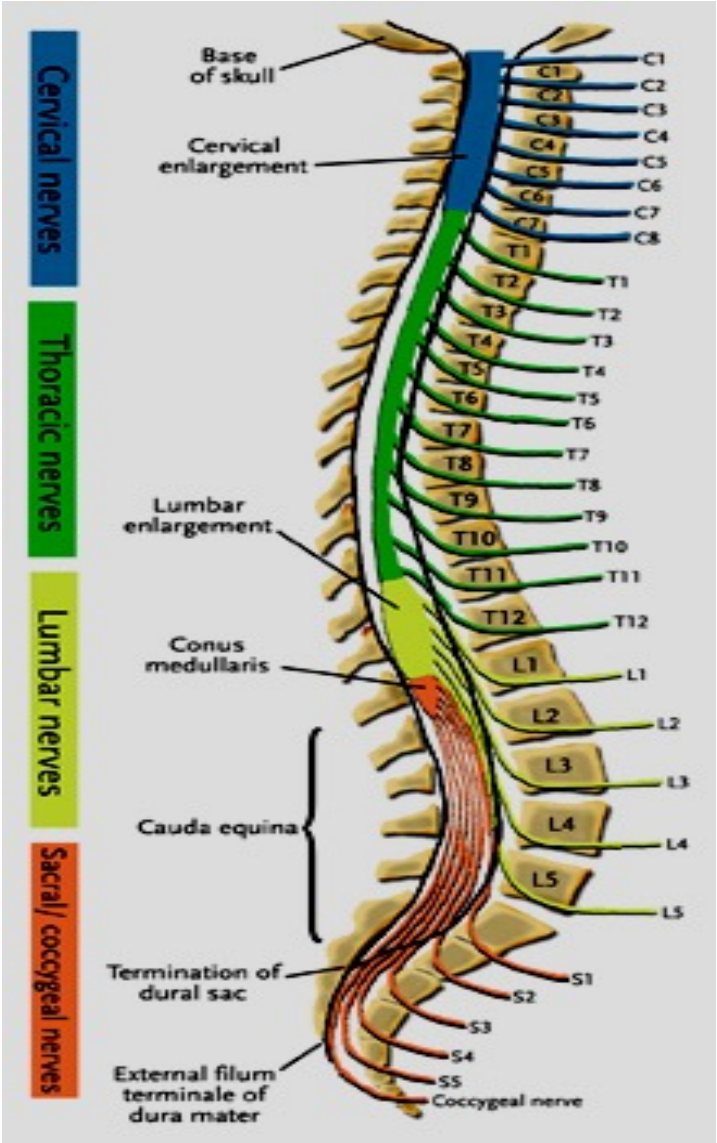


The Spinal Cord

Gross features:

- It is **cylindrical** in shape, about **45 cm** in length .
- It begins at the upper border of atlas vertebra (C1)
- It ends at the intervertebral disc between the **1st & 2nd lumbar vertebrae.**
- Its lower end is conical in shape & is known as "**Conus Medullaris**"
- It Organized into 31 spinal segments

- Cervical : 8
- Thoracic : 12
- Lumbar : 5
- Sacral : 5
- Coccygeal : 1



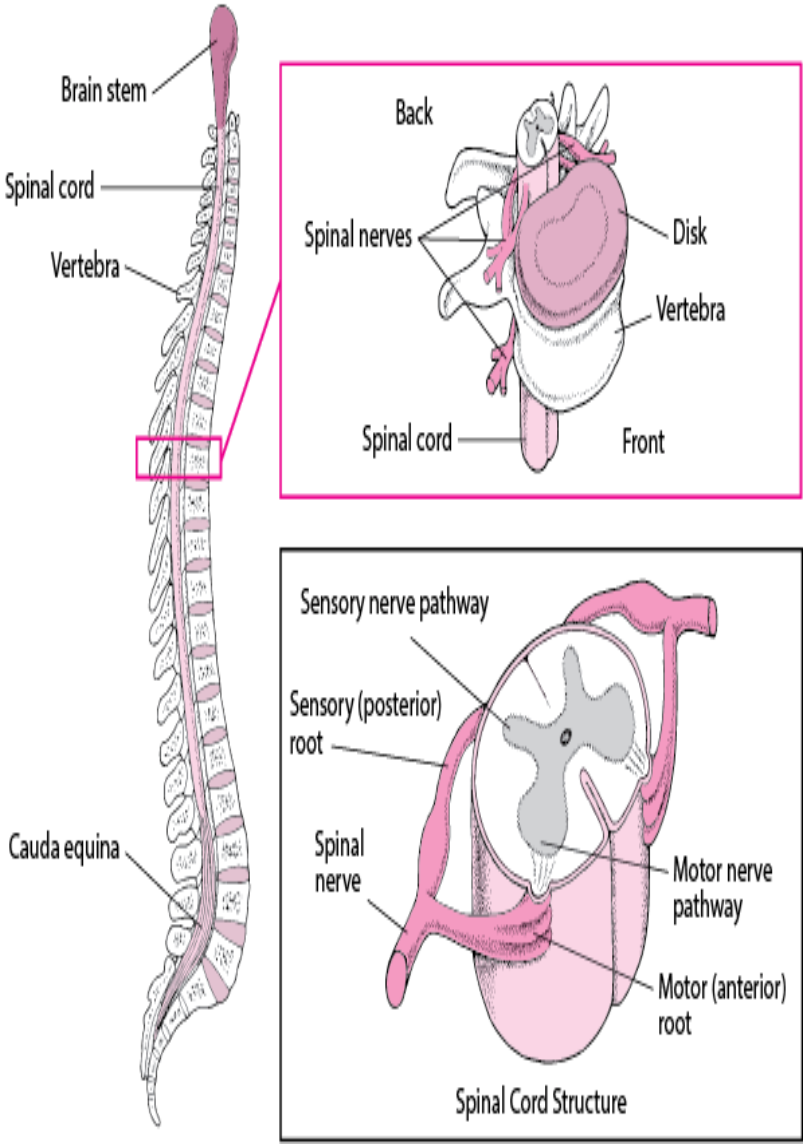
Each segment gives **2** spinal nerves, that leave through Intervertebral foramen of the same level of its spinal segment.

The roots of Lumbosacral nerves gathered inferiorly as group of fibers called ***Cauda equina*** *(horse tail)*.

<u>The spinal cord has **2 enlargements**:</u>

Cervical (C5-T1)

Lumbar (L1-S3)



Internal structure of the spinal cord:

1)Central canal : contains CSF.

2)Grey matter is H-shape & it has

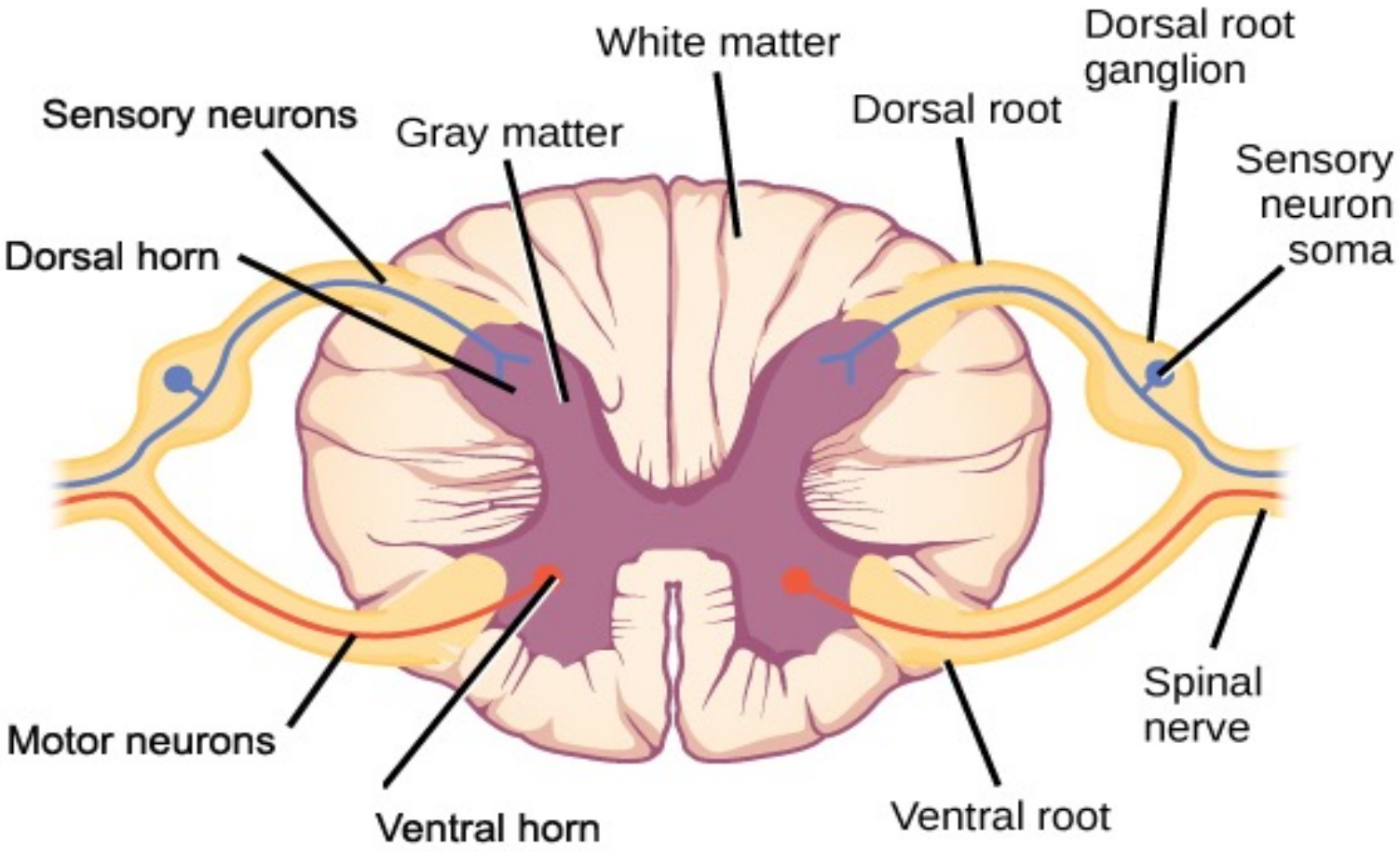
2 ventral horns (contain motor nuclei)

2 dorsal horns (contain **s**ensory nuclei)

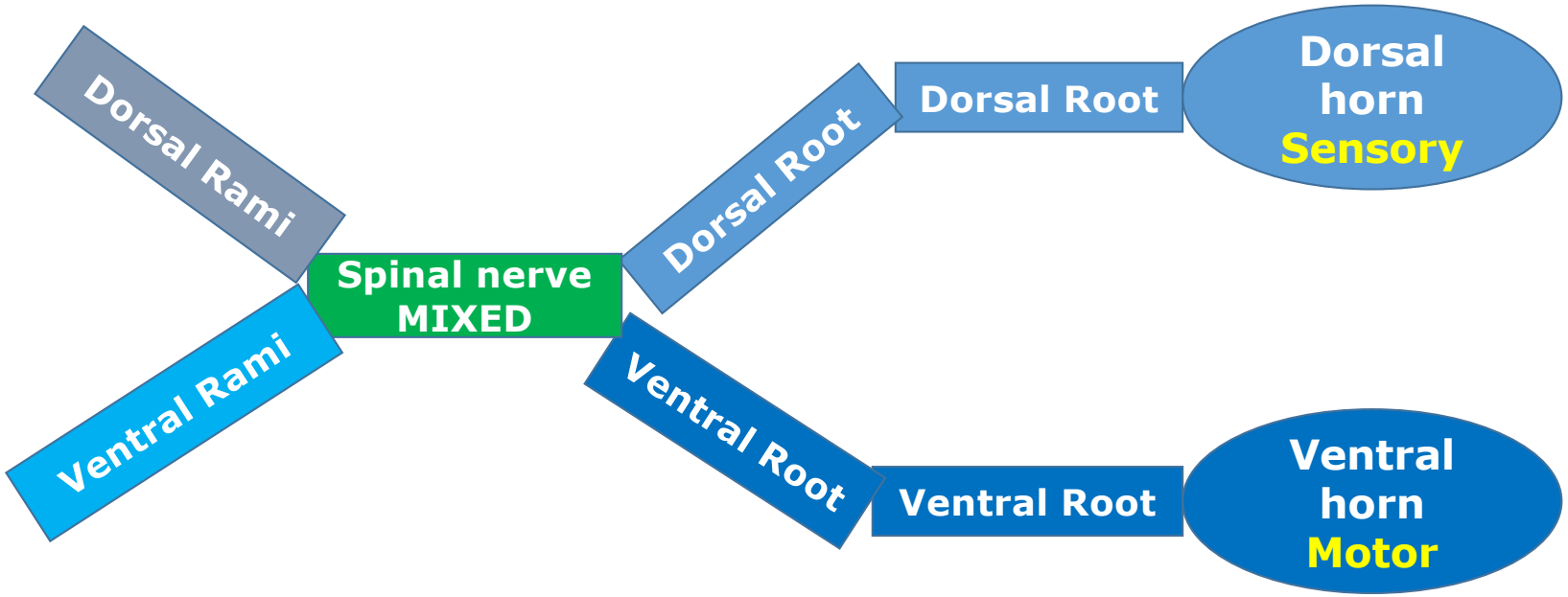
2 lateral horns (from T1-L2. that contain sympathetic nuclei).

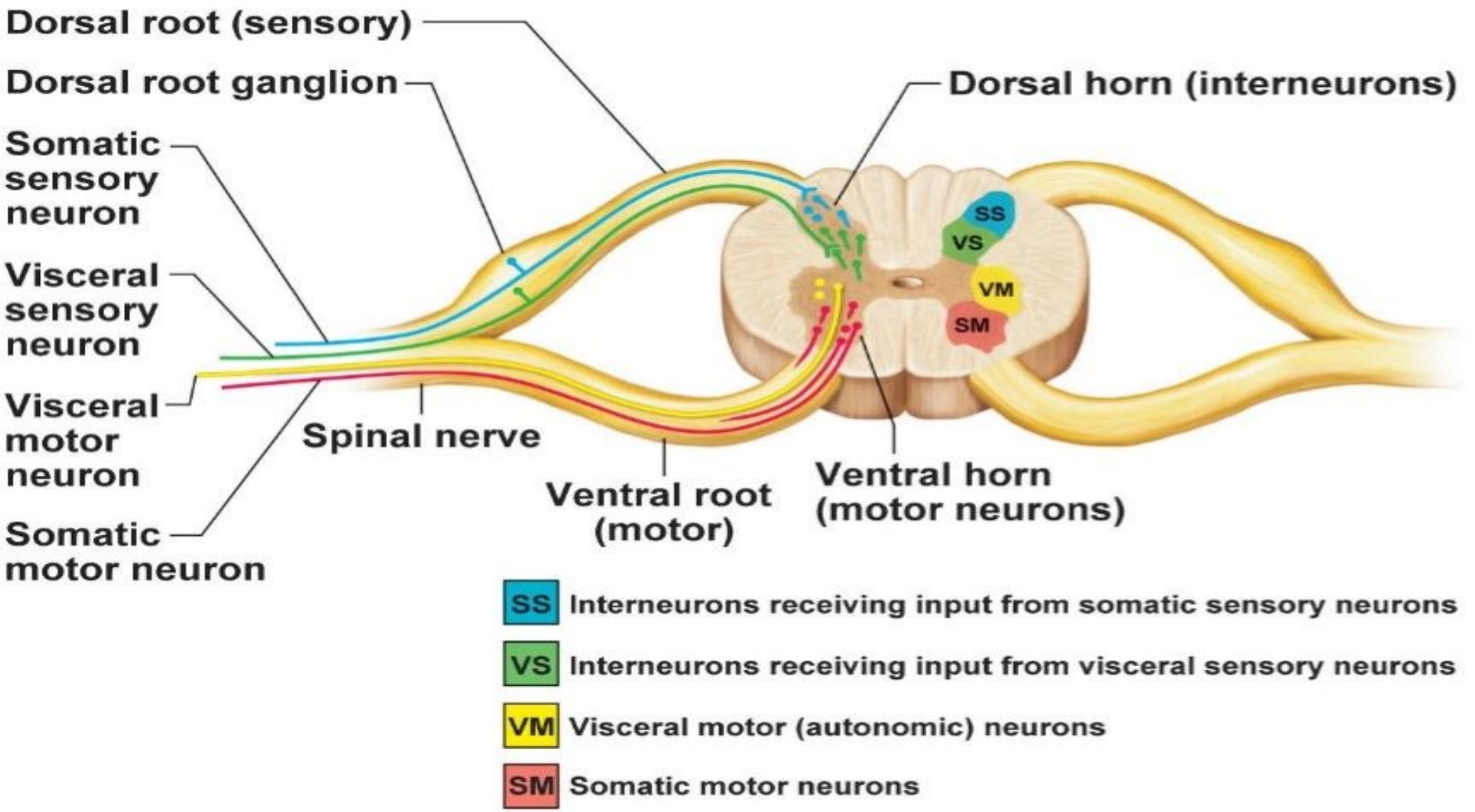
3) White matter Surrounds the grey matter & is formed of ascending & descending tracts.

It is divided into 3 funiculi; anterior (ventral), lateral & posterior (dorsal).



Cross Section of Spinal Cord


Dorsal Rami
Ventral Rami
Spinal nerve
MIXED
Dorsal Root
Dorsal Root
Dorsal
horn
Sensory
Ventral Root
Ventral Root
Ventral
horn
Motor


Dorsal root (sensory)
Dorsal root ganglion
Somatic sensory neuron
Visceral sensory neuron
Visceral motor neuron
Somatic motor neuron
Spinal nerve
Ventral root (motor)
Dorsal horn (interneurons)
Ventral horn (motor neurons)
SS
VS
VM
SM
SS Interneurons receiving input from somatic sensory neurons
VS Interneurons receiving input from visceral sensory neurons
VM Visceral motor (autonomic) neurons
SM Somatic motor neurons

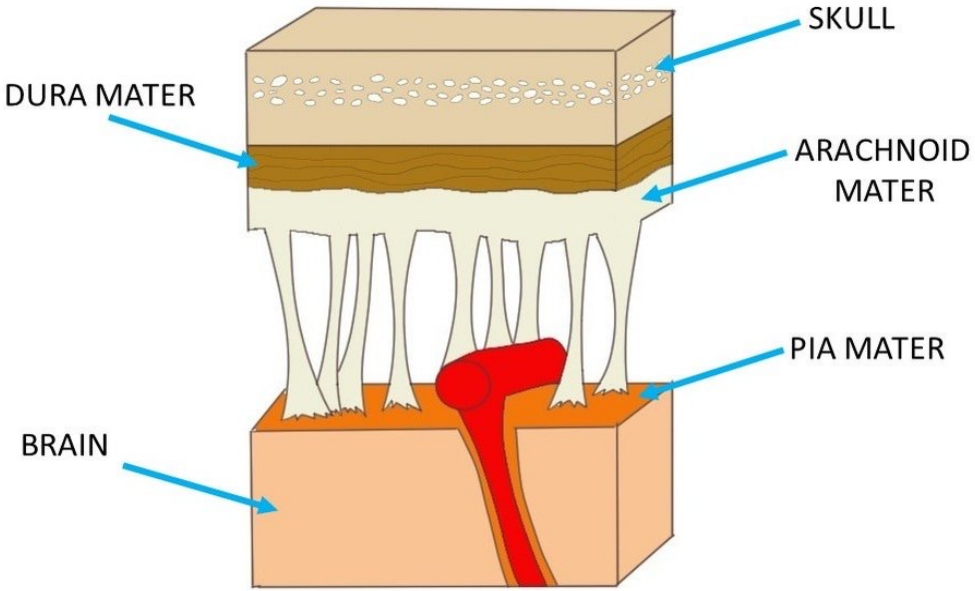
The Meninges

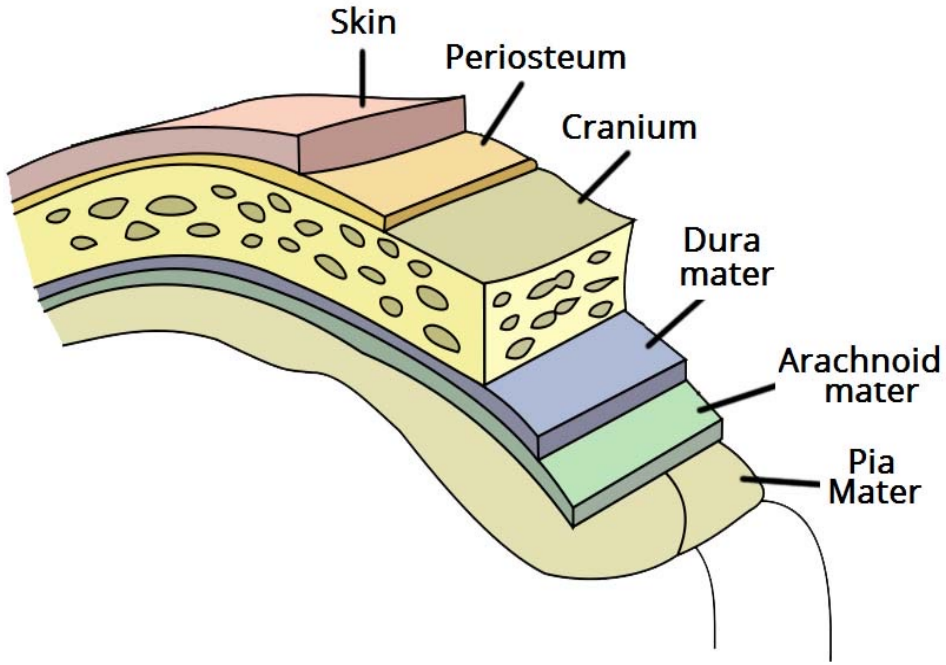
The brain is covered with 3 layers (meninges):

1-Dura (outer layer): Dense layer of fibrous tissue.

2-Arachnoid (middle layer): Delicate CT membrane.

3-Pia (inner layer) : Transparent fibrous membrane that stick on the spinal cord.





Meningeal spaces

Meningeal spaces located between the 3 meninges and the vertebral canal.

Include 3 spaces:

Extradural space

Filled with fat, Connective Tissue and blood vessels.

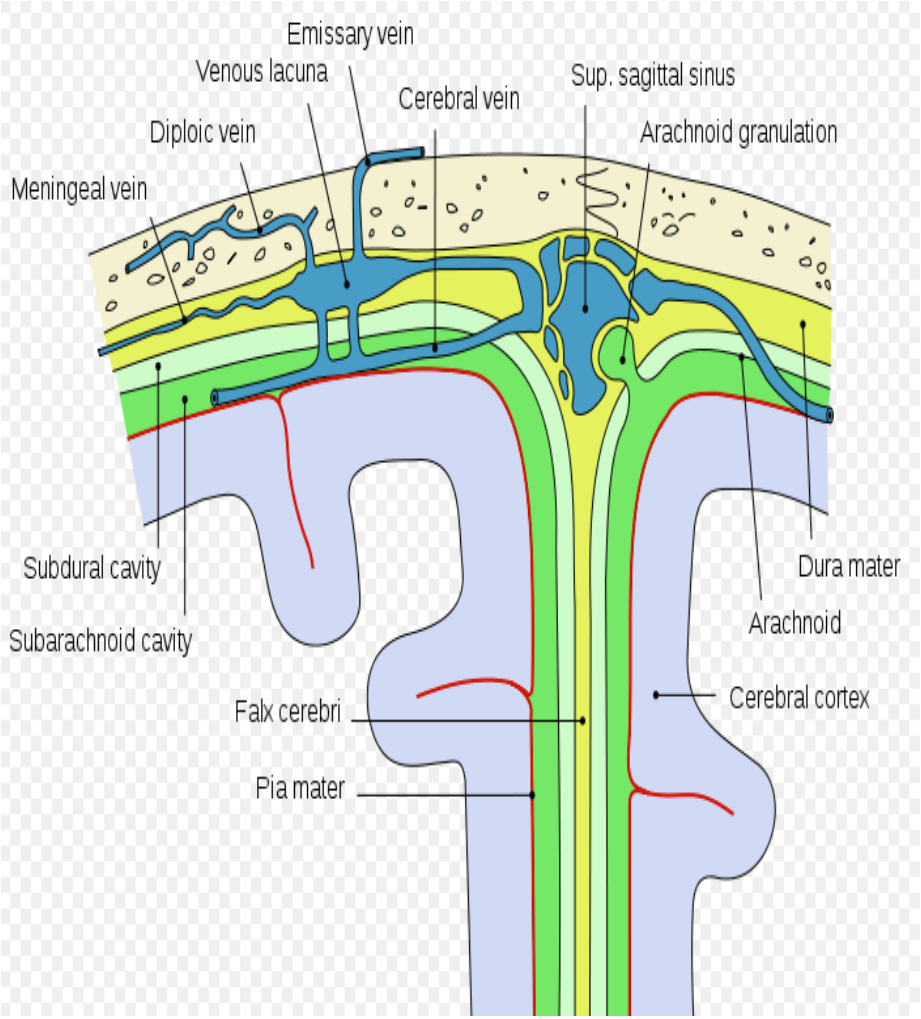
Subdural space

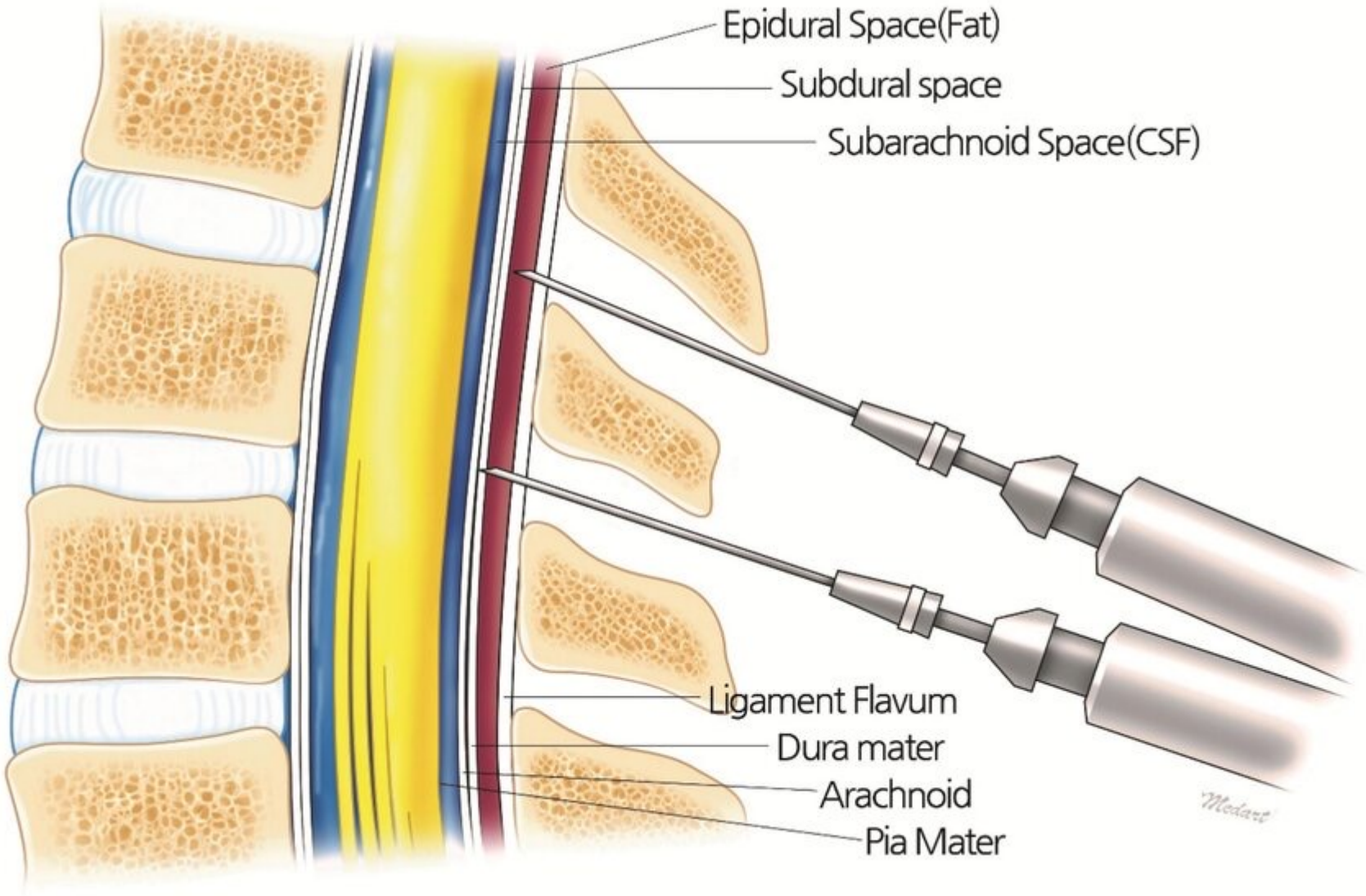
Contains serous fluid.

Subarachnoid space

A wide space that Contains cerebrospinal fluid (CSF)

Extends to lower border of S**2**.




Epidural Space(Fat)
Subdural space
Subarachnoid Space(CSF)
Ligament Flavum
Dura mater
Arachnoid
Pia Mater

The Cerebrospinal Fluid (CSF)

It is the fluid filling the ventricles & central canals of the CNS .

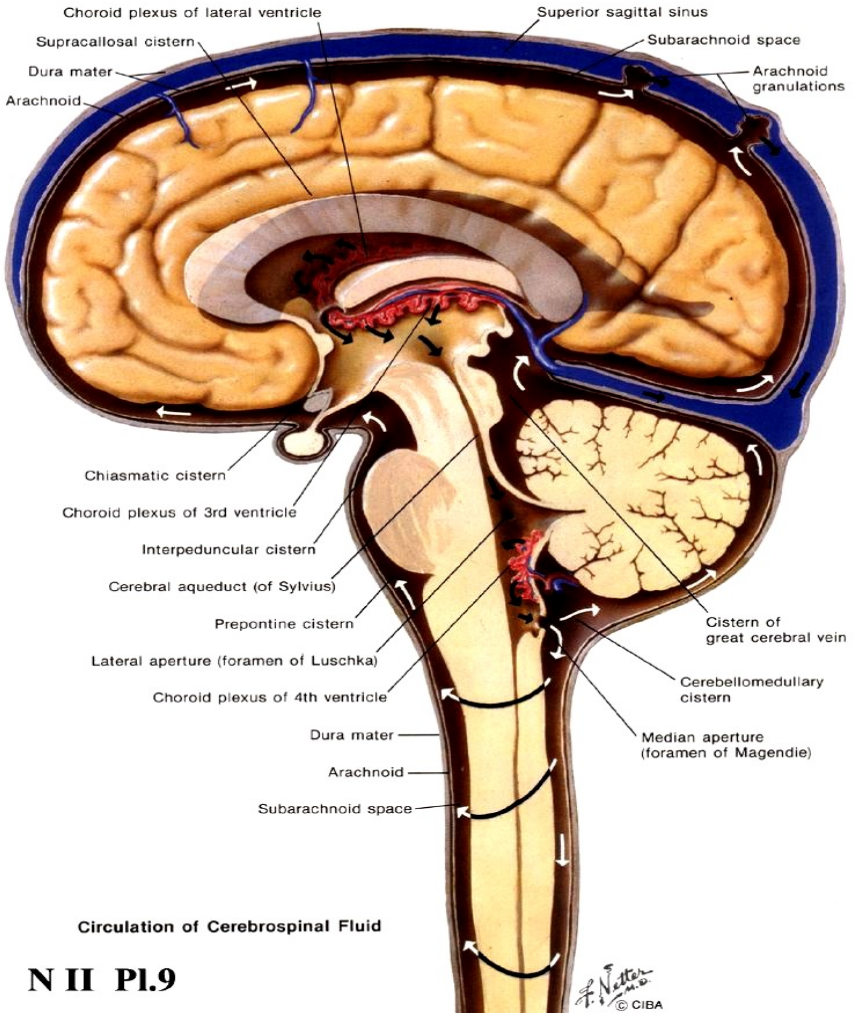
Production of CSF: It is secreted by the **choroid plexuses**

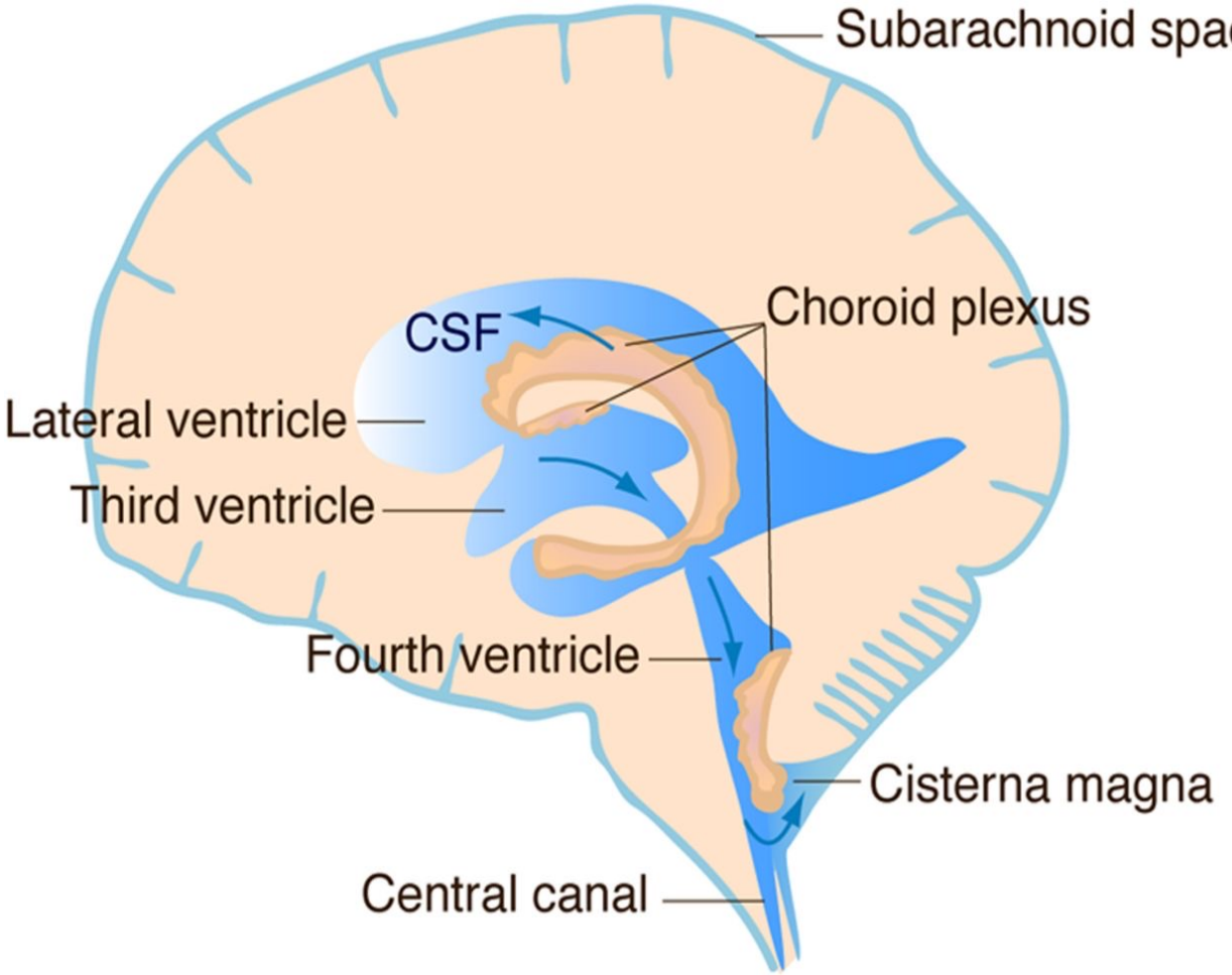
Circulation of CSF: It circulates in the ventricles & central canals of the CNS.

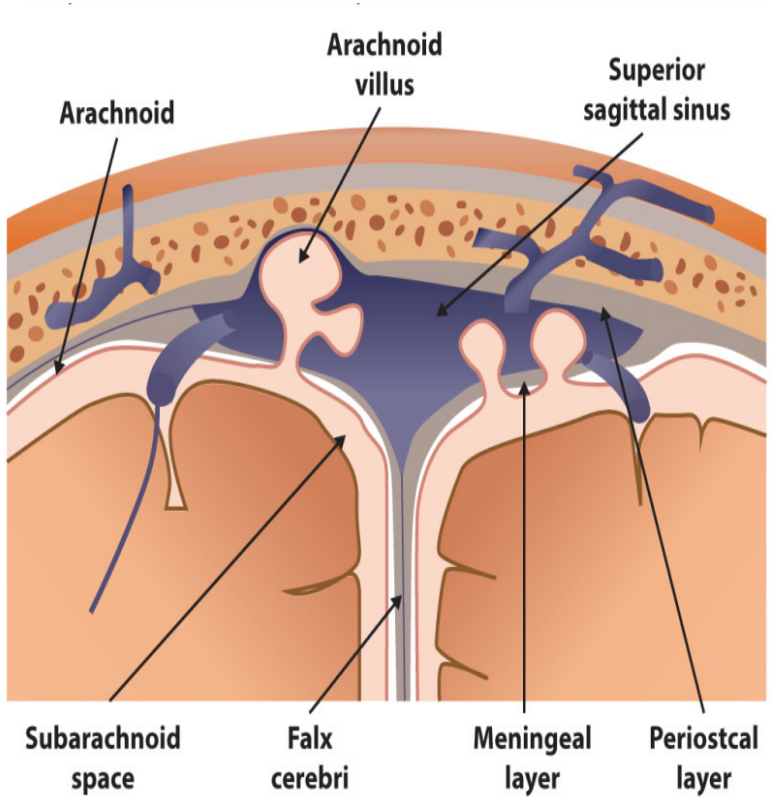
It circulates within subarachnoid space

Absorption of CSF: It is absorbed by **arachnoid villi & granulations** to be excreted into the dural venous sinuses.

Function : It forms a water cushion to protect the brain & spinal cord.




Subarachnoid space
Choroid plexus
CSF
Lateral ventricle
Third ventricle
Fourth ventricle
Cisterna magna
Central canal


Arachnoid villus
Superior sagittal sinus
Arachnoid
Subarachnoid space
Falx cerebri
Meningeal layer
Periostcal layer

Thank you!